AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Previously Presented) A pump comprising:

a pump body for at least partially defining a pumping chamber;

a piezoelectric actuator situated in the pump body and responsive to a drive signal for pumping fluid in the pumping chamber; and

a drive circuit which applies the drive signal to the piezoelectric actuator as a series of digital pulses.

2. (Original) The pump of claim 1, wherein the drive circuit further comprises:

a pulse generator which generates digital pulses;

a converter circuit which uses the digital pulses generated by the pulse generator to produce the series of high voltage charge packets.

3. (Original) The pump of claim 2, wherein the drive circuit further comprises the piezoelectric actuator, and wherein the piezoelectric actuator, by a capacitive nature of the piezoelectric actuator, integrates the charge packets to shape a waveform of the drive signal.

4. (Original) The pump of claim 2, wherein the pulse generator comprises a pulsed width modulator (PWM) circuit.

5. (Original) The pump of claim 4, wherein the pulsed width modulator (PWM) circuit comprises a microcontroller.

6. (Original) The pump of claim 4, wherein the pulses generated by the pulsed width modulator (PWM) circuit have a pulse width chosen to produced a desired amplitude for the drive signal.

7. (Previously Presented) A method of operating a piezoelectric pump having a piezoelectric actuator situated in a pump body and responsive to a drive signal for pumping fluid, the method comprising:

applying a series of digital pulses as the drive signal to the piezoelectric actuator;

operating the piezoelectric actuator in response to the drive signal.

8. (Original) The method of claim 7, further comprising:

(1) generating digital pulses;

(2) using the digital pulses of step (1) to produce the series of high voltage charge packets.

9. (Original) The pump of claim 8, further comprising using the piezoelectric actuator to integrate the charge packets and thereby shape a waveform of the drive signal.

10. (Original) The pump of claim 7, further comprising modulating a pulse width of the digital pulses of step (1) in accordance with a desired waveform for the drive signal.

11. (Withdrawn) A drive circuit which produces a drive signal for a device having a piezoelectric actuator, the piezoelectric actuator forming a part of the drive circuit and serving to shape a waveform of the drive signal.

12. (Withdrawn) The drive circuit of claim 11, wherein the drive circuit comprises:

a pulse generator which generates digital pulses;

a converter circuit which uses the digital pulses generated by the pulse generator to produce high voltage charge packets; and

wherein the piezoelectric actuator, by a capacitive nature of the piezoelectric actuator, integrates the charge packets to shape the waveform of the drive signal.

13. (Withdrawn) The drive circuit of claim 12, wherein the pulse generator comprises a pulsed width modulator (PWM) circuit.

14. (Withdrawn) The drive circuit of claim 13, wherein the pulsed width modulator (PWM) circuit comprises a microcontroller.

15. (Withdrawn) The drive circuit of claim 13, wherein the digital pulses generated by the pulsed width modulator (PWM) circuit have a pulse width chosen to produced a desired amplitude for the drive signal.

16. (Withdrawn) The drive circuit of claim 12, wherein the converter circuit comprises a flyback circuit.

17. (Withdrawn) The drive circuit of claim 16, wherein the flyback circuit produces potentials that are bipolar with respect to an electrical ground.

18. (Withdrawn) The drive circuit of claim 12, further comprising a filter for filtering components of the charge packets produced by the converter circuit.

19. (Withdrawn) The drive circuit of claim 12, wherein a frequency of the charge packets produced by the converter circuit is greater than an ability of the piezoelectric actuator to mechanically respond.

20. (Withdrawn) The drive circuit of claim 19, wherein the frequency of the charge packets produced by the converter circuit is chosen to be greater than an ability of the piezoelectric actuator to mechanically respond so that the charge packets produced by the converter circuit do not contribute to one of mechanical inefficiency and noise in the piezoelectric actuator.

21. (Withdrawn) The drive circuit of claim 12, wherein the charge packets comprise positive and negative pulses, and wherein the piezoelectric actuator integrates the positive pulses and the negative pulses to yield a drive field that approximates a sine wave.

22. (Withdrawn) The drive circuit of claim 12, wherein neither a bridge switching circuit nor a charge storage circuit are connected between the converter circuit and the piezoelectric actuator.

23. (Previously Presented) A pump comprising:

a pump body for at least partially defining a pumping chamber;

a piezoelectric actuator situated in the pump body and responsive to a drive signal for pumping fluidin the pumping chamber; and

a drive circuit which produces the drive signal, the piezoelectric actuator forming a part of the drive circuit and serving to shape a waveform of the drive signal.

24. (Original) The pump of claim 23, wherein the drive circuit comprises:

a pulse generator which generates digital pulses;

a converter circuit which uses the digital pulses generated by the pulse generator to produce high voltage charge packets; and

wherein the piezoelectric actuator, by a capacitive nature of the piezoelectric actuator, integrates the charge packets to shape the waveform of the drive signal.

25. (Original) The pump of claim 24, wherein the pulse generator comprises a pulsed width modulator (PWM) circuit.

26. (Original) The pump of claim 24, wherein the pulsed width modulator (PWM) circuit comprises a microcontroller.

27. (Original) The pump of claim 24, wherein the digital pulses generated by the pulsed width modulator (PWM) circuit have a pulse width chosen to produced a desired amplitude for the drive signal.

28. (Original) The pump of claim 24, wherein the converter circuit comprises a flyback circuit.

29. (Original) The pump of claim 24, wherein the flyback circuit produces potentials that are bipolar with respect to an electrical ground.

30. (Original) The pump of claim 24, further comprising a filter for filtering components of the charge packets produced by the converter circuit.

31. (Original) The pump of claim 24, wherein a frequency of the pulses produced by the converter circuit is greater than an ability of the piezoelectric actuator to mechanically respond.

32. (Original) The pump of claim 31, wherein the frequency of the charge packets produced by the converter circuit is chosen to be greater than an ability of the piezoelectric actuator to mechanically respond so that the charge packets produced by the converter circuit do not contribute to one of mechanical inefficiency and noise in the piezoelectric actuator.

33. (Original) The pump of claim 24, wherein the charge packets comprise positive pulses and negative pulses, and wherein the piezoelectric actuator integrates the positive pulses and the negative pulses to yield a drive field that approximates a sine wave.

34. (Original) The pump of claim 24, wherein neither a bridge switching circuit nor a charge storage circuit are connected between the converter circuit and the piezoelectric actuator.

35. (Previously Presented) A pump comprising:

a pump body for at least partially defining a pumping chamber;

a piezoelectric actuator situated in the pump body and responsive to a drive signal for pumping fluid in the pumping chamber;

a power supply; and

a drive circuit which is powered by the power supply and which produces the drive signal;

wherein the piezoelectric actuator serves as a voltage storage device for the power supply.

36. (Original) The pump of claim 35, wherein the drive circuit comprises:

a pulse generator which generates digital pulses;

a converter circuit which uses the digital pulses generated by the pulse generator to produce high voltage charge packets; and

wherein the piezoelectric actuator, by a capacitive nature of the piezoelectric actuator, integrates the charge packets to shape a waveform of the drive signal.

37. (Original) The pump of claim 36, wherein the pulse generator comprises a pulsed width modulator (PWM) circuit.

38. (Original) The pump of claim 36, wherein the charge packets comprise positive pulses and negative pulses, and wherein the piezoelectric actuator integrates the positive pulses and the negative pulses to yield a drive field that approximates a sine wave.

39. (Original) The pump of claim 37, wherein the digital pulses generated by the pulsed width modulator (PWM) circuit have a pulse width chosen to produced a desired amplitude for the drive signal.

40. (Withdrawn) A method of operating a device having a piezoelectric actuator which is responsive to a drive signal, the method comprising:

(1) generating digital pulses;

(2) using the digital pulses of step (1) to produce high voltage charge packets; and

(3) using the piezoelectric actuator to integrate the charge packets and thereby shape a waveform of the drive signal.

41. (Withdrawn) The method of claim 40, further comprising using a pulsed width modulator (PWM) circuit to generate the digital pulses of step (1).

42. (Withdrawn) The method of claim 40, further comprising generating the digital pulses of step (1) to have a pulse width chosen to produced a desired amplitude for the drive signal.

43. (Withdrawn) The method of claim 40, further comprising using a flyback circuit to produce the charge packets.

44. (Withdrawn) The method of claim 43, further comprising using the flyback circuit to produce potentials that are bipolar with respect to an electrical ground.

45. (Withdrawn) The method of claim 40, further comprising filtering components of the charge packets.

46. (Withdrawn) The method of claim 40, further comprising setting a frequency of the charge packets to be greater than an ability of the piezoelectric actuator to mechanically respond.

47. (Withdrawn) The method of claim 46, further comprising setting the frequency of the charge packets to be greater than an ability of the piezoelectric actuator to mechanically respond so that the charge packets do not contribute to one of mechanical inefficiency and noise in the piezoelectric actuator.

48. (Withdrawn) The method of claim 40, wherein the charge packets comprise positive pulses and negative pulses, and wherein the piezoelectric actuator integrates the positive pulses and the negative pulses to yield a drive field that approximates a sine wave.

49. (Withdrawn) A method of operating a device having a piezoelectric actuator which is responsive to a drive signal, the method comprising::

using a power supply to power a drive circuit which generates the drive signal, the drive signal comprising charge pulses;

using the piezoelectric actuator to integrate the charge packets into an electric field;

using the piezoelectric actuator to store charge and thereby serve as a charge storage device for the power supply.

50. (Withdrawn) The method of claim 49, further comprising using a pulsed width modulator (PWM) circuit to generate the charge pulses.

51. (Withdrawn) A piezoelectrically-operated apparatus comprising:

a piezoelectric actuator which is responsive to a drive signal; and

a drive circuit which applies the drive signal to the piezoelectric actuator as a series of digital pulses.

52. (Withdrawn) The apparatus of claim 51, wherein the drive circuit further comprises:

a pulse generator which generates digital pulses;

a converter circuit which uses the digital pulses generated by the pulse generator to produce the series of high voltage charge packets.

53. (Withdrawn) The apparatus of claim 52, wherein the drive circuit further comprises the piezoelectric actuator, and wherein the piezoelectric actuator, by a capacitive nature of the piezoelectric actuator, integrates the charge packets to shape a waveform of the drive signal.

54. (Withdrawn) The apparatus of claim 52, wherein the pulse generator comprises a pulsed width modulator (PWM) circuit.

55. (Withdrawn) The apparatus of claim 54, wherein the pulsed width modulator (PWM) circuit comprises a microcontroller.

56. (Withdrawn) The apparatus of claim 54, wherein the pulses generated by the pulsed width modulator (PWM) circuit have a pulse width chosen to produced a desired amplitude for the drive signal.

57. (Withdrawn) A piezoelectrically-operated apparatus comprising:

a piezoelectric actuator which is responsive to a drive signal; and

a drive circuit which produces the drive signal, the piezoelectric actuator forming a part of the drive circuit and serving to shape a waveform of the drive signal.

58. (Withdrawn) The apparatus of claim 57, wherein the drive circuit comprises:

a pulse generator which generates digital pulses;

a converter circuit which uses the digital pulses generated by the pulse generator to produce high voltage charge packets; and

wherein the piezoelectric actuator, by a capacitive nature of the piezoelectric actuator, integrates the charge packets to shape the waveform of the drive signal.

59. (Withdrawn) The apparatus of claim 58, wherein the pulse generator comprises a pulsed width modulator (PWM) circuit.

60. (Withdrawn) The apparatus of claim 58, wherein the pulsed width modulator (PWM) circuit comprises a microcontroller.

61. (Withdrawn) The apparatus of claim 58, wherein the digital pulses generated by the pulsed width modulator (PWM) circuit have a pulse width chosen to produced a desired amplitude for the drive signal.

62. (Withdrawn) The apparatus of claim 58, wherein the converter circuit comprises a flyback circuit.

63. (Withdrawn) The apparatus of claim 58, wherein the flyback circuit produces potentials that are bipolar with respect to an electrical ground.

64. (Withdrawn) The apparatus of claim 58, further comprising a filter for filtering components of the charge packets produced by the converter circuit.

65. (Withdrawn) The apparatus of claim 58, wherein a frequency of the pulses produced by the converter circuit is greater than an ability of the piezoelectric actuator to mechanically respond.

66. (Withdrawn) The apparatus of claim 65, wherein the frequency of the charge packets produced by the converter circuit is chosen to be greater than an ability of the piezoelectric actuator to mechanically respond so that the charge packets produced by the converter circuit do not contribute to one of mechanical inefficiency and noise in the piezoelectric actuator.

67. (Withdrawn) The apparatus of claim 58, wherein the charge packets comprise positive pulses and negative pulses, and wherein the piezoelectric actuator integrates the positive pulses and the negative pulses to yield a drive field that approximates a sine wave.

68. (Withdrawn) The apparatus of claim 58, wherein neither a bridge switching circuit nor a charge storage circuit are connected between the converter circuit and the piezoelectric actuator.

69. (Withdrawn) A drive circuit which produces a drive signal for a piezoelectric actuator, the drive circuit comprising:

a source of digital pulses;

a transformer;

a power switching element which receives the digital pulses and selectively applies current to the transformer;

means for using an electromotive force generated by parasitic capacitance of the transformer to provide a high voltage bipolar output to the piezoelectric actuator.

70. (Withdrawn) The apparatus of claim 69, wherein the transformer is has only one secondary winding with no taps.

71. (Withdrawn) The apparatus of claim 69, wherein the source produces a single PWM pulse train.

72. (Withdrawn) The apparatus of claim 69, wherein the source produces a unipolar, low frequency, low potential control signal to the means for using an electromotive force.

73. (Withdrawn) The apparatus of claim 69, further comprising a second transformer connected in parallel to the transformer.

74. (New) The pump of claim 1, wherein the drive circuit comprises:

a source of digital pulses;

a transformer;

a power switching element which receives the digital pulses and selectively applies current to the transformer;

means for using an electromotive force generated by parasitic capacitance of the transformer to provide a high voltage bipolar output to the piezoelectric actuator.

75. (New) The apparatus of claim 74, wherein the transformer is has only one secondary winding with no taps.

76. (New) The apparatus of claim 74, wherein the source produces a single PWM pulse train.

77. (New) The apparatus of claim 74, wherein the source produces a unipolar, low frequency, low potential control signal to the means for using an electromotive force.

78. (New) The apparatus of claim 74, further comprising a second transformer connected in parallel to the transformer